

LIQUID CRYSTAL DISPLAY MODULE

Product Specification

CUSTOMER	
CUSTOMER PART NUMBER	
PRODUCT NUMBER	TSR67802

Product Mgr	Electrical Eng	Document Control
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Date:12 July 2006	Date:12 July 2006	Date:12 July 2006

- ☐ **Approval for Specification only**
- ☐ **Approval for Specification and Sample**

Product No.	TSR67802 Rev A	REV. A
	LF32021-I270-VTP-C03	

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REVISION RECORD

Rev.	Date	Page	Chapt.	Comment	ECN no.
A				New Release	

1 MAIN FEATURES

ITEM	CONTENTS
Display Format	320 x RGB x 234 Dots
Colour	R.G.B. Stripe, 32K
Overall Dimensions	148.0mm (W) x 120.0mm (H) x 22.2 Max
Viewing Area	145.48mm (W) x 86.91mm (H)
LCD Type	TFT
Mode	Transmissive - Negative
Viewing Angle	6:00
Duty Ratio	1/234
Driver IC	Hit1270
Interface	8 bit parallel for 80 or 68 series microprocessors
Backlight Type	EDGE CCFL
DC/DC Converter	Built-In
Temperature compensation	Built-In
Operating Temperature	0°C ~ +60°C
Storage Temperature	-25°C ~ +80°C
Touch Panel	Built-In
Character fonts	5x8 alphanumeric font English, Japanese and European character (Cyrillic, Danish, Finnish, French, German, Greek, Iceland, Italian, Netherlands, Norwegian, Portuguese, Russian, Spanish, Swedish) 16x16 alphanumeric font English
Optional	Downloadable picture from PC using RS232 interface and Densitron download kit
RoHS compliant	Yes

2 MECHANICAL SPECIFICATION

2.1 MECHANICAL CHARACTERISTICS

ITEM	CHARACTERISTIC	UNIT
Display Format	320 x RGB x 234 Dots	
Overall Dimensions	148.0 (W) x 120.0 (H) x 22.2 Max	mm
Viewing Area	145.48 (W) x 86.91 (H)	mm
Active Area	113.3 (W) x 84.7 (H)	mm
Dot Pitch	0.118 (W) x RGB x 0.362 (H)	mm
IC Controller/Driver	Hit1270	

2.2 LABELLING & MARKING

DENSITRON TSR67802 TAIWAN YYMM

3 ELECTRICAL SPECIFICATION

3.1 ABSOLUTE MAXIMUM RATINGS

VSS = 0 V, Ta = 25 °C

Item	Symbol	Min	Max	Unit	Note
Power Supply Voltage	V _{DD}	0	5.5	V	
Operating Temperature	Top	0	+60	°C	
Storage Temperature	Tst	-25	+80	°C	Note 1

Note 1: <48 hrs @20~90% RH, <1000 hrs @20~65% RH.

3.2 ELECTRICAL CHARACTERISTICS

VSS = 0 V, Ta = 25 °C

Item	Symbol	Condition	Min	Typ	Max	Unit
Power Supply for Logic	V _{DD}	Ta = 25°C	4.8	5.0	5.2	V
Input Voltage	V _{IHC}	Ta = 25°C	0.8V _{DD}	--	V _{DD}	V
	V _{ILC}	Ta = 25°C	0	--	0.2V _{DD}	V
Current Consumption	* I _{DD}	V _{DD} = 5V	--	550	--	mA

- I_{DD} measurement condition is for all patterns ON

3.3 DC CHARACTERISTICS (Touch Panel)

VSS = 0 V, Ta = 25 °C

Item	Symbol	Condition	Spec			Unit
			Min	Typ	Max	
Operating voltage	V _{DD}	-	3	-	5.5	V

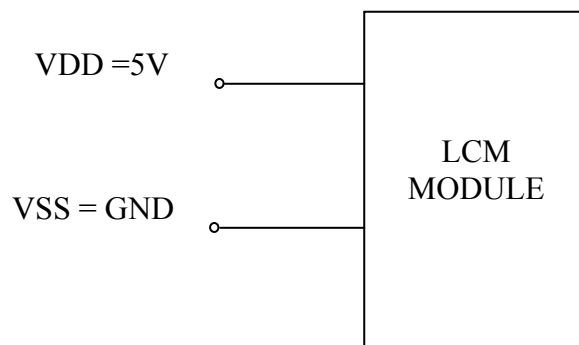
3.4 INTERFACE PIN ASSIGNMENT / TFT

Pin No.	Function	Level	Description
1	Vss	---	Power Supply (OV,GND)
2	Vdd	---	Power Supply for Logic
3	N/C	---	No connection
4	/RD	H/L	Read signal
5	/WR	H/L	Write signal
6	A0	H/L	H : parameter register L : command register
7	DB0	H/L	Display Data 0
8	DB1	H/L	Display Data 1
9	DB2	H/L	Display Data 2
10	DB3	H/L	Display Data 3
11	DB4	H/L	Display Data 4
12	DB5	H/L	Display Data 5
13	DB6	H/L	Display Data 6
14	DB7	H/L	Display Data 7
15	/CS	H/L	Chip select
16	/RST	L	Reset signal
17	N/C	---	No connection
18	FG	---	Frame Ground
19	/Wait	H/L	H : release command L : busy
20	N/C	---	No connection

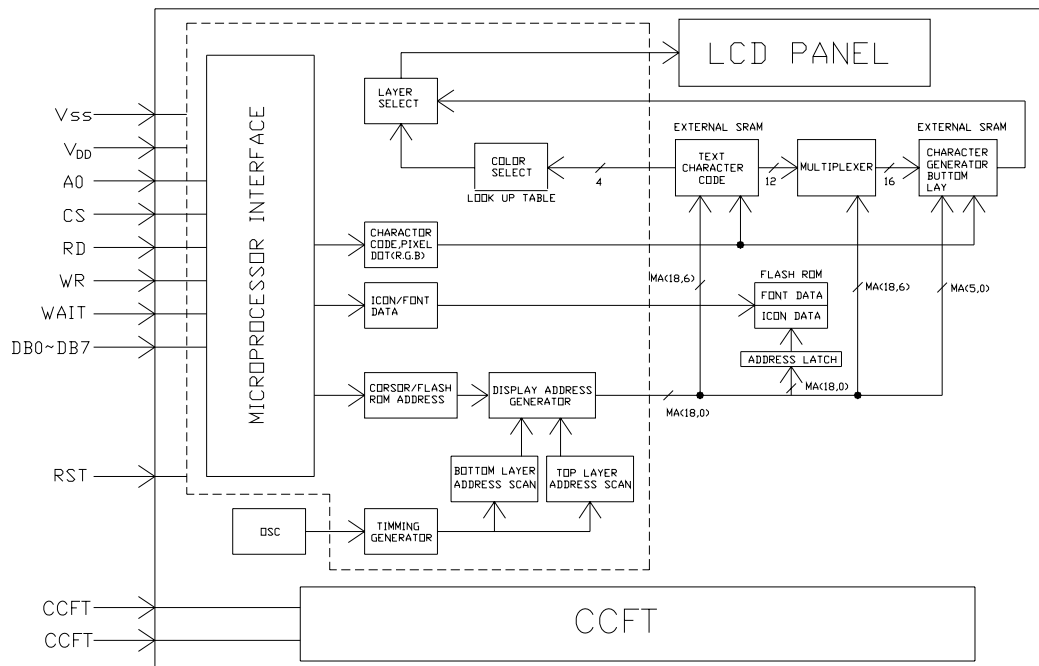
3.5 INTERFACE PIN ASSIGNMENT / TOUCH PANEL

Pin No.	Function	Level	Description
1	Bottom	---	Bottom electrode - differential analogue
2	Left	---	Left electrode - differential analogue
3	Top	---	Top electrode - differential analogue
4	Right	---	Right electrode - differential analogue

3.6 POWER SUPPLY CIRCUIT



3.7 BLOCK DIAGRAM



3.8 TIMING CHARACTERISTICS

Note: Please reference the manufacturer's datasheet for the Hit1270 controller.

3.9 ROM ADDRESS

- 8M bit ROM (512K x 16 bit)
- Address: 0~3FFF: 5x8 character font like English and Japanese (can't be erased)
- Address: 4000~7FFF: 5x8 character font like English European character (can't be erased)
- Address: 8000~BFFF: 5x8 character font like English European character (can't be erased)
- Address: C000~13FFF: 16x16 character font like English and number (can't be erased)
- Address: 14000~17FFF: Reserved (can't be erased)
- Address: 18000~1FFFF: report.txt to describe the starting and ending address of every picture (photo) and character (controlled by software)
- Address: 20000~7FFFF: developed by user (can be erased)

3.10 RAM ADDRESS

- Text Mode: 0h ~ 487Fh
- Graphics Mode: 18000h ~ 24A7Fh

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3.11 CHARACTER FONT

3.11.1 Address: 0 ~ 3FFF ----- 5X8 character font like English and Japanese

		Lower[3..0]															
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Lower[7..4]	0																
	1																
	2		!	"	#	\$	%	&	'	()	*	+	,	-	.	/
	3	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
	4	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
	5	P	Q	R	S	T	U	V	W	X	Y	Z	[¥]	^	_
	6	`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
	7	p	q	r	s	t	u	v	w	x	y	z	{		}	~	+
	8																
	9																
	A	ー	ア	イ	ウ	エ	オ	カ	キ	ク	ケ	コ	サ	シ	ス	セ	ソ
	B	ー	ア	イ	ウ	エ	オ	カ	キ	ク	ケ	コ	サ	シ	ス	セ	ソ
	C	タ	チ	ツ	テ	ト	ナ	ニ	ヌ	ネ	ノ	ハ	ヒ	フ	ヘ	ホ	マ
	D	ミ	ム	メ	モ	ヤ	ユ	ヨ	ラ	リ	ル	レ	ロ	ワ	ン	ッ	マ
	E																
	F																

3.11.2 Address: 4000 ~ 7FFF ----- 5X8 character font like English European character.

		Lower[3..0]															
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Lower[7..4]	0																
	1																
	2		!	"	#	\$	%	&	'	()	*	+	,	-	.	/
	3	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
	4	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
	5	P	Q	R	S	T	U	V	W	X	Y	Z	[¥]	^	_
	6	`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
	7	p	q	r	s	t	u	v	w	x	y	z	{		}	~	+
	8	ü	û	ë	ä	ö	ä	ö	ü	ë	ä	ö	ü	ë	ä	ö	ü
	9	ä	ö	ü	ë	ä	ö	ü	ë	ä	ö	ü	ë	ä	ö	ü	ë
	A	ä	ö	ü	ë	ä	ö	ü	ë	ä	ö	ü	ë	ä	ö	ü	ë
	B	ä	ö	ü	ë	ä	ö	ü	ë	ä	ö	ü	ë	ä	ö	ü	ë
	C	ä	ö	ü	ë	ä	ö	ü	ë	ä	ö	ü	ë	ä	ö	ü	ë
	D	ä	ö	ü	ë	ä	ö	ü	ë	ä	ö	ü	ë	ä	ö	ü	ë
	E																
	F																

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3.11.3 Address: 8000 ~ BFFF ----- 5X8 character font like English European character.

		Lower[3..0]															
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Lower[7..4]	0																
	1																
	2	Б	Г	Ё	Ж	З	И	Й	Л	П	У	Ф	Ч	Ш	Ъ	Ы	Э
	3	Ю	Я	б	в	г	ё	ж	з	и	й	к	л	м	н	п	т
	4	ч	ш	ъ	ы	э	ю	я	«	»	„	”	№	¿	¡	£	¢
	5	.	-	=	!	?	x	%	^	~	↑	↓	←	→	↖	↗	•
	6	“	”	„	”	„	“	”	„	”	„	“	”	„	”	„	“
	7	“	”	„	”	„	“	”	„	”	„	“	”	„	”	„	“
	8	“	”	„	”	„	“	”	„	”	„	“	”	„	”	„	“
	9	“	”	„	”	„	“	”	„	”	„	“	”	„	”	„	“
	A	“	”	„	”	„	“	”	„	”	„	“	”	„	”	„	“
	B	“	”	„	”	„	“	”	„	”	„	“	”	„	”	„	“
	C	“	”	„	”	„	“	”	„	”	„	“	”	„	”	„	“
	D	“	”	„	”	„	“	”	„	”	„	“	”	„	”	„	“
	E	“	”	„	”	„	“	”	„	”	„	“	”	„	”	„	“
	F	“	”	„	”	„	“	”	„	”	„	“	”	„	”	„	“

3.11.4 Address: C000 ~ 13FFF ----- 16X16 character font like English character and number.

		Lower[5..0]															
		00-03	04-07	08-0B	0C-0F	10-13	14-17	18-1B	1C-1F	20-23	24-27	28-2B	2C-2F	30-33	34-37	38-3B	3C-3F
Lower[8..6]	0																
	1																
	2		!	"	#	\$	%	&	'	()	*	+	,	-	.	/
	3	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
	4	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
	5	P	Q	R	S	T	U	V	W	X	Y	Z	[\]	^	_
	6	,	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
	7	p	q	r	s	t	u	v	w	x	y	z	{		}	~	

4 OPTICAL SPECIFICATION

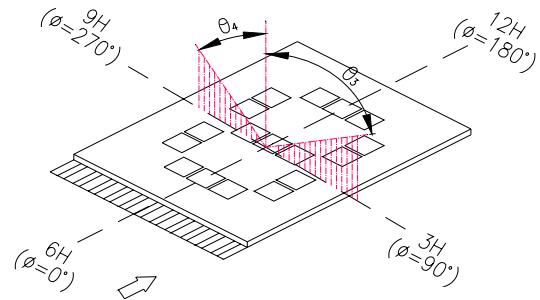
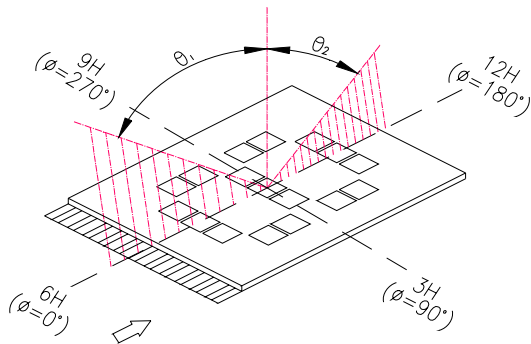
4.1 OPTICAL CHARACTERISTICS

Ta = 25 °C

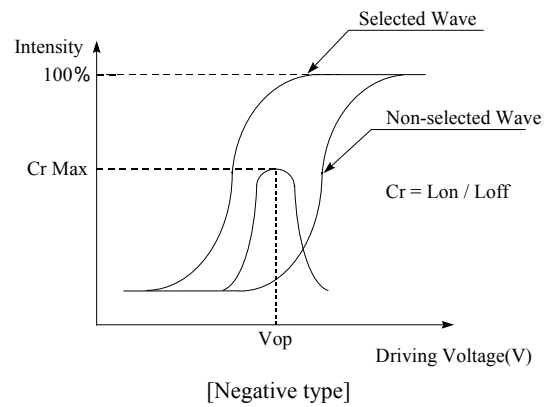
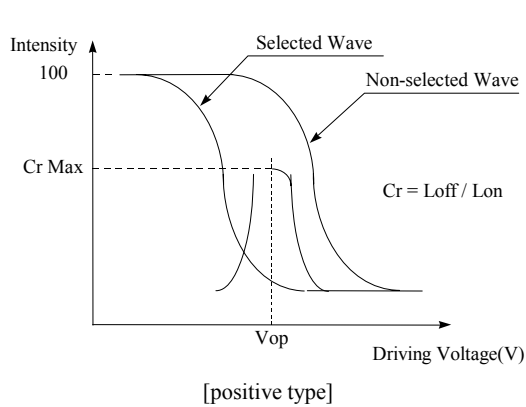
Item		Symbol	Condition	Min	Typ	Max	Unit	Note
Viewing Angle	0°	θ1 Down	CR≥2	--	50	--	deg	1
	180°	θ2 Up	CR≥2	--	30	--	deg	1
	90°	θ3 Right	CR≥2	--	50	--	deg	2
	270°	θ4 Left	CR≥2	--	30	--	deg	2
Contrast Ratio		CR	Ta = 25 °C	--	250	--	-	3
Response Time		Tr	Ta = 25 °C	--	15	30	ms	4
		Tf	Ta = 25 °C	--	20	40		
Driving Method		Duty	1/234					
LCD Type		TFT – (Negative / Transmissive)						
Viewing Direction		6:00						

Note 1: definition of viewing angle θ_1 & θ_2

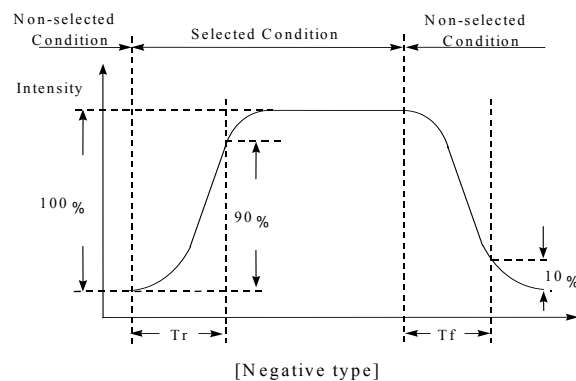
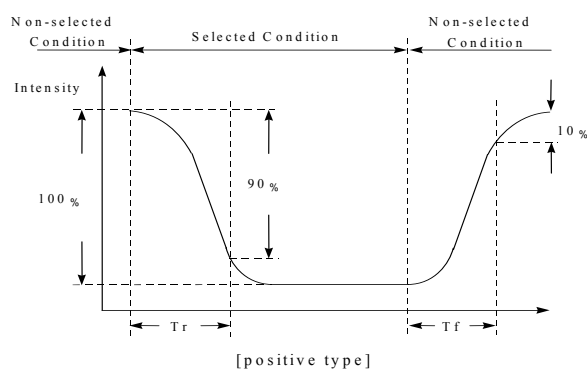
Note 2: definition of viewing angle θ_3 & θ_4



Note 3: definition of contrast ratio (CR)



Note 4: definition of response time



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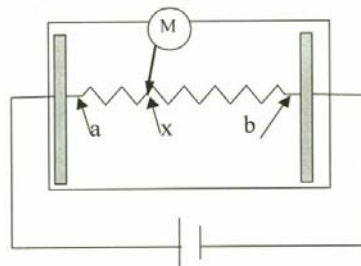
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5 TOUCH PANEL CHARACTERISTICS

Description	Specification	Condition
Transparency	$\geq 80\%$	ASTM D1003 (wavelength = 550 nm)
Linearity	$\leq 1.5\%$	Material of pen : Poly-acetal resin End shape: R0.8mm Test Point : 100 points Test Force : 80gf (Pls note 1)
Circuit Resistance(X-axis)	300 ohm ~ 1100 ohm	At connector
Circuit Resistance(Y-axis)	200 ohm ~ 500 ohm	At connector
Insulation Resistance	$\geq 20\text{M ohm}$	At DC 25V
Chattering time	$\leq 10\text{ms}$	Voltage : 3V Frequency : 5 Hz
Activation force	5 gf ~ 80 gf	End shape : R0.8mm Resistance must be equal or lower than 2K ohm between X and Y axis when testing voltage is 5V.

Note 1: Measurement condition of Linearity

Linearity Definition



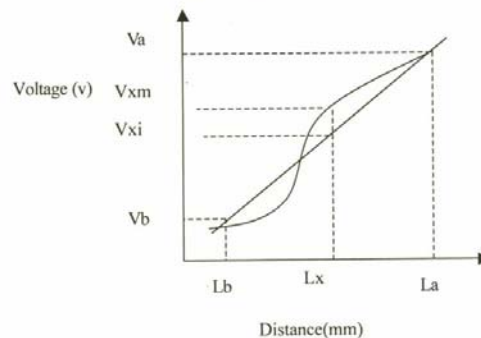
Va : maximum voltage in the active area of touch panel

Vb: minimum voltage in the active area of touch panel

X : random measuring point

Vxm: Actual voltage of Lx point

Vxi : Theoretical voltage of Lx point



$$\text{Linearity} : [| V_{xi} - V_{xm} | / (V_a - V_b)] * 100\%$$

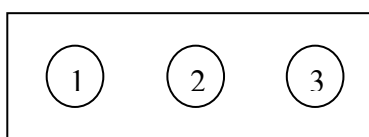
6 BACKLIGHT SPECIFICATION

6.1 Edge CCFL B/L Operating Range

Item	Conditions	Standard			Unit	Remark
		Min.	Typ.	Max.		
Starting voltage	Ta = 0 C	---	---	910	Vrms	
	Ta = 25 C	---	---	650	Vrms	
Lamp voltage	Ta = 25 C	---	470	528	Vrms	
Lamp current	Ta = 25 C	5.9	6.0	6.1	mA	
Oscillation frequency	Ta = 25 C	---	60.0	80.0	KHz	
Lamp life	Ta = 25 C , IL = 6 mA Humidity : 30%RH ~ 85%RH	---	20,000	---	Hrs	Note 3
Operating Temp.	Humidity : 30%RH ~ 85%RH	0	---	60	C	
Storage Temp.	Humidity : 30%RH ~ 85%RH	-30	---	80	C	
Brightness uniformity	Ta = 25 C , IL = 6 mA	80	---	---	%	Note 1
Average brightness of white	Ta = 25 C , IL = 6 mA	250	300	---		Note 2

Note :

- 1 : Average brightness of 3 points when B/L is used at the beginning.
- 2 : Brightness uniformity = (MIN / MAX) x 100 %
- 3 : Half of the original average brightness.



7 QUALITY ASSURANCE SPECIFICATION

7.1 CONFORMITY

The performance, function and reliability of the shipped products conform to the Product Specification.

7.2 DELIVERY ASSURANCE

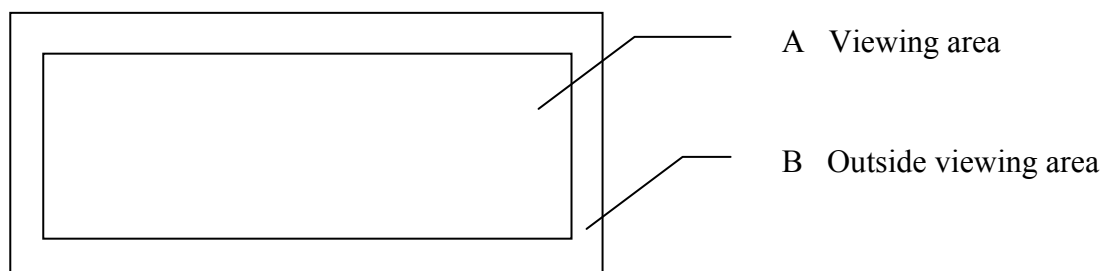
7.2.1 Delivery inspection standards

- MIL-STD-105E, general inspection level II, single sampling level;
- IPC-AA610 rev. C, class 2 electronic assemblies standard

The quality assurance levels are shown below:

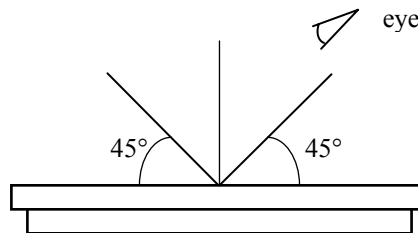
Class	AQL (%)
Critical defect	0.5%
Major defect	1.0%
Minor defect	1.5%
TOTAL	2.0%

7.2.2 Zone definition



7.2.3 Visual inspection

- Inspect under 2x20W or 40W fluorescent lamp (approximately 3000 lux) leaving 25 to 30 cm between the module and the lamp and 30 cm between the module and the eye (measuring position).
- Appearance is inspected at the best contrast voltage (best contrast is adjusted considering clearness and crosstalk on screen).
- Inspect the module at 45° right and left, top and bottom.
- Use the optimum viewing angle during the contrast inspection.



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7.3 STANDARD OF APPEARANCE INSPECTION

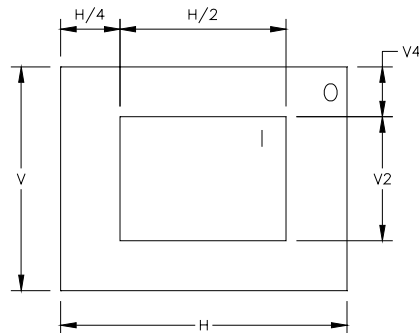
7.3.1 Inspection of Dot

- A. Inspection pattern : Full white, full black, red, green, and blue screens.
B. The definition of display area :

Item	Zone		Total
	I	O	
Black dot defect	≤ 3	≤ 5	≤ 7
Bright dot defect (red, green, blue and white)	≤ 0	≤ 3	≤ 3
Total	≤ 2	≤ 6	≤ 8

Note

1. Dot defect is defined as the defective area of the dot area is larger than 50% of the dot area and it is visible through the 5% N.D. filter.
2. The distance between black dot defects or black and bright dot defects should be more than 5mm apart.
3. The distance between bright dot defects (red, green, blue and white) should be more than 15mm apart.



7.3.2 Scratches, Dent and Extraneous Substances

Criteria:

Item		Acceptable criteria	
Scratch on the polarizer L : Length (mm) W : Width (mm)		L ≤ 0.5 W ≤ 0.5	Ignore
		W ≤ 0.1	Ignore
		0.5 < L ≤ 10 0.1 ≤ W ≤ 0.5	N ≤ 4
		0.5 ≤ W	None
		10 < L 0.1 < W	None
Dent / Bubble on the polarizer D : Average diameter (mm)		D ≤ 0.25	Ignore
		0.25 < D ≤ 0.5	N ≤ 4
		0.5 < D	None
Extraneous substances	Black spots	D ≤ 0.25	Ignore
		0.25 < D ≤ 0.5	N ≤ 3
		0.5 < D	None
	Naps	L ≤ 0.5 W ≤ 0.5	Ignore
		W ≤ 0.1	Ignore
		0.5 < L ≤ 3 0.1 ≤ W ≤ 0.5	N ≤ 3
		0.5 < W	None
		3 < L 0.1 < W	None

Note :

1. Polarizer bubble is defined as the bubble appears on active display area. The defect of polarizer bubble shall be ignored if the polarizer bubble appears on the outside of active display area.
2. The extraneous substance is defined as it appears when powering on the module.

7.3.3 Afterimage

1. After displaying a pattern for 5 seconds then switching to a different pattern, the previous pattern should disappear within 10 seconds.

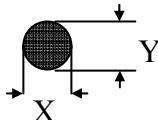
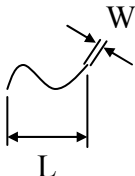
Note: Following defect to be judged by limit samples when necessary.

- A. Rubbing Mark.
- B. Mottling (Uniformity).

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7.3.4 INSPECTION OF DOT (TOUCH PANEL)

No	Item	Criteria																		
1	Black spot, white spot, dust	<p>Round type: as per following drawing</p> <p>$\varnothing = (X+Y)/2$</p> <div></div> <table><tr><th colspan="3">Acceptable quantity</th></tr><tr><th>Size</th><th>Zone A</th><th>Zone B</th></tr><tr><td>$\varnothing \leq 0.3$</td><td>5</td><td rowspan="2">Any number</td></tr><tr><td>$0.3 < \varnothing < 0.25$</td><td>0</td></tr></table>	Acceptable quantity			Size	Zone A	Zone B	$\varnothing \leq 0.3$	5	Any number	$0.3 < \varnothing < 0.25$	0							
		Acceptable quantity																		
Size	Zone A	Zone B																		
$\varnothing \leq 0.3$	5	Any number																		
$0.3 < \varnothing < 0.25$	0																			
		<p>Line type: as per following drawing</p> <div></div> <table><tr><th colspan="4">Acceptable quantity</th></tr><tr><th>Length</th><th>Width</th><th>Zone A</th><th>Zone B</th></tr><tr><td>- -</td><td>$W \leq 0.03$</td><td>Any number</td><td rowspan="3">Any number</td></tr><tr><td>$L \leq 10.0$</td><td>$W \leq 0.05$</td><td>5</td></tr><tr><td>$L > 10.0$</td><td>$0.05 < W$</td><td>0</td></tr></table>	Acceptable quantity				Length	Width	Zone A	Zone B	- -	$W \leq 0.03$	Any number	Any number	$L \leq 10.0$	$W \leq 0.05$	5	$L > 10.0$	$0.05 < W$	0
Acceptable quantity																				
Length	Width	Zone A	Zone B																	
- -	$W \leq 0.03$	Any number	Any number																	
$L \leq 10.0$	$W \leq 0.05$	5																		
$L > 10.0$	$0.05 < W$	0																		
		<p>Note : Zone A means viewing area and zone B means other area except viewing area.</p>																		

7.4 DEALING WITH CUSTOMER COMPLAINTS

7.4.1 Non-conforming analysis

Purchaser should supply Densitron with detailed data of non-conforming sample.
After accepting it, Densitron should complete the analysis in two weeks from receiving the sample.
If the analysis cannot be completed on time, Densitron must inform the purchaser.

7.4.2 Handling of non-conforming displays

If any non-conforming displays are found during customer acceptance inspection which Densitron is clearly responsible for, return them to Densitron.
Both Densitron and customer should analyse the reason and discuss the handling of non-conforming displays when the reason is not clear.
Equally, both sides should discuss and come to agreement for issues pertaining to modification of Densitron quality assurance standard.

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8 RELIABILITY SPECIFICATION

8.1 RELIABILITY TESTS

Test Item	Test Condition	Evaluation and assessment
Operation at high temperature	60°C±2°C for 240 hours	No abnormalities in function* and appearance**
Low temperature	0°C±2°C for 240 hours	No abnormalities in function* and appearance**
Heat Shock	-30°C (30 min.) ->25°C (5 min.) ->80°C (30 min.) ->->25°C (5 min.) 5 cycle	No abnormalities in function* and appearance**
Vibration	10Hz ~ 55Hz 0.3mm / 1 Octave 55Hz ~ 500Hz 3g / 1 Octave 20 cycles / per axis	No abnormalities in function* and appearance**
Drop Shock	Drop Shock	No abnormalities in function* and appearance**

Current consumption <3 times the initial value

Contrast >1/2 times the initial value

8.2 DURABILITY TEST (TOUCH PANEL)

Description	Specification	Condition
Pen sliding durability	>= 100K times	End shape : R0.8mm Load force : 250gf Writing speed: 300 mm/sec Material of pen : Poly-acetal resin Sliding length : 35mm
Knocking test	>= 1 million times	End shape : R0.8mm(Hardness ; 50~60 degree) Load force : 250gf Frequency : 5 Hz (By silicon rubber tapping at same points)
Hardness of surface	3H	JIS K 5400

8.3 LIFE TIME

Item	Description
1	Function, performance, appearance, etc. shall be free from remarkable deterioration within 50,000 hours under ordinary operating and storage conditions of room temperature (25 ± 10 °C), normal humidity ($45\pm 20\%$ RH), and in area not exposed to direct sunlight.

9 HANDLING PRECAUTIONS

Safety

If the LCD panel breaks, be careful not to get the liquid crystal fluid in your mouth or in your eyes. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and plenty of water.

Mounting and Design

Place a transparent plate (e.g. acrylic, polycarbonate or glass) on the display surface to protect the display from external pressure. Leave a small gap between the transparent plate and the display surface.

When assembling with a zebra connector, clean the surface of the pads with alcohol and keep the surrounding air very clean.

Design the system so that no input signal is given unless the power supply voltage is applied.

Caution during LCD cleaning

Lightly wipe the display surface with a soft cloth soaked with Isopropyl alcohol, Ethyl alcohol or Trichlorotrifluoroethane.

Do not wipe the display surface with dry or hard materials that will damage the polariser surface.

Do not use aromatic solvents (toluene and xylene), or ketonic solvents (ketone and acetone).

Caution against static charge

As the display uses C-MOS LSI drivers, connect any unused input terminal to VDD or VSS. Do not input any signals before power is turned on. Also, ground your body, work/assembly table and assembly equipment to protect against static electricity.

Packaging

Displays use LCD elements, and must be treated as such. Avoid strong shock and drop from a height. To prevent displays from degradation, do not operate or store them exposed directly to sunshine or high temperature/humidity.

Caution during operation

It is indispensable to drive the display within the specified voltage limit since excessive voltage shortens its life. Direct current causes an electrochemical reaction with remarkable deterioration of the display quality. Give careful consideration to prevent direct current during ON/OFF timing and during operation. Response time is extremely delayed at temperatures lower than the operating temperature range while, at high temperatures, displays become dark. However, this phenomenon is reversible and does not mean a malfunction or a display that has been permanently damaged. If the display area is pushed on hard during operation, some graphics will be abnormally displayed but returns to a normal condition after turning off the display once. Even a small amount of condensation on the contact pads (terminals) can cause an electro-chemical reaction which causes missing rows and columns. Give careful attention to avoid condensation.

Storage

Store the display in a dark place where the temperature is $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$ and the humidity below 50%RH. Store the display in a clean environment, free from dust, organic solvents and corrosive gases. Do not crash, shake or jolt the display (including accessories).